Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 16 (5): 1119–1123
https://doi.org/10.15560/16.5.1119

PENSOFT

First confirmed record of the Guianan White-eared Opossum, *Didelphis imperfecta* Mondolfi & Pérez-Hernández, 1984 (Didelphimorphia, Didelphidae), from Colombia

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Abstract

We report the first confirmed occurrence of the Guianan White-eared Opossum, *Didelphis imperfecta* Mondolfi & Pérez-Herneńdez, 1984 (Didelphimorphia, Didelphidae), from Colombia. The individual was captured in a tropical lowland rain forest in the easternmost portion of the Colombian Orinoco Llanos region. The species is endemic of the Guiana Shield and has the smallest distribution area among the species of the genus. Our record shows that the Orinoco river does not constitute a biogeographical barrier for the species. To date, only two species of the genus *Didelphis* Linnaeus, 1758 have been recorded in Colombia, our results increase the reported number of records for this genus.

Keywords

Gallery forest, geographic distribution, Mammalia, Neotropical savannas, Vichada.

Academic editor: William Tavares | Received 24 June 2020 | Accepted 27 August 2020 | Published 8 September 2020

Citation: González TM, Moreno-Niño N, Molina E, Armenteras D (2020) First confirmed record of the Guianan White-eared Oposum, *Didelphis imperfecta* Mondolfi & Pérez-Hernández, 1984 (Didelphimorphia, Didelphidae), from Colombia. Check List 16 (5): 1119–1123. https://doi.org/10.15560/16.5.1119

Introduction

The New World genus *Didelphis* Linnaeus, 1758 is composed by six species: *D. virginiana* Allen, 1900 which is distributed through Central and North America (Cerqueira and Tribe 2008; Dias and Perini 2018), and the other five distributed along Central and South America in two groups; black-eared and white-eared species. The former group includes: *D. marsupialis* Linnaeus, 1758, that is distributed in South and Central America, and the Caribbean Island of Trinidad and Tobago, and *D. aurita* Wied-Neuwied, 1826, distributed in coastal Brazil, east of the lower Rio Paraguay and northeastern Argentina (Cerqueira and Tribe 2008; Astúa 2015; Dias and Perini 2018). The later group encompasses three species: *D. albiventris* Lund, 1840, distributed in open deciduous forests of Argentina, Bolivia, Paraguay, Uruguay, and the center and south of Brazil; *D. pernigra* Allen, 1900, partially distributed in the north Andean region in elevations between 2,300 and 3,300 m a.s.l.; and *D. imperfecta* Mondolfi & Pérez-Hernández, 1984, present at lowland tropical forests in French Guiana, Guyana, Suriname, south of Venezuela and north of Brazil (Fig. 1) (Cerqueira and Tribe 2008; Astúa 2015; Dias and Perini 2018). To date, only two of these species have been recorded in Colombia, *D. marsupialis* and *D. pernigra*

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(Ramírez-Chaves et al. 2020).

Didelphis imperfecta is a poorly known species that inhabits high and lowlands of tropical forests, it is a scansorial, solitary, and nocturnal species that feeds on fruits and insects (Pérez-Hernández et al. 2016; Barros Faria and Melo 2017). The distribution of this species is restricted to the Guiana region and has the smallest distribution area amongst the species of the genus *Didelphis*. The current known distribution comprises five countries south and east of the Orinoco River. The species has been reported in forests of the state of Amazonas in Venezuela, the lowland forests of Venezuela, Guyana, and French Guiana, and lowland primary forests of French Guiana (Ventura et al. 2002; Cerqueira and Tribe 2008), and north of Brazil, comprising the states of Roraima, Amazonas, Amapá and Pará (Faria and Melo 2017). Currently, this species is categorized as Least Concern (LC) by the International Union for Conservation of Nature (IUCN) since its populations are considered to have a good state (Pérez-Hernández et al. 2016). Here, we present the first confirmed record of *D. imperfecta* from Colombia and west of the Orinoco River.

Methods

Study area. The El Tuparro National Natural Park (hereafter, El Tuparro NNP) is a protected area located in the Colombian Orinoco Llanos region at the east of the Department of Vichada; corresponding to the west limit of the Guiana Shield (Villarreal-Leal and Maldonado-Ocampo 2007). The protected area has limits with the Orinoco river at the east, the Tomo River at the north, the Tuparrito and Tuparro Rivers at the south, and the Hormiga and Janipa streams at the west (Villarreal-Leal and Maldonado-Ocampo 2007; Mendoza-Cifuentes and Córdoba-Sánchez 2018) (Fig. 1). The park has a humid tropical climate with an elevation range between 80 to 315 m a.s.l., a yearly average temperature of 27 °C, and a monomodal precipitation regime with a rainy season from April to October. During the wet season, seasonal flooding of most of the ecosystems occurs, followed by a dry season from November to March, during which wildfires are frequent (Villarreal-Leal and Maldonado-Ocampo 2007; Mendoza-Cifuentes and Córdoba-Sánchez 2018). The park landscape is composed by a mosaic of natural savannas with gallery forests, associated to water bodies, and rocky outcrops that belong to the Guiana Shield (Villarreal-Leal and Maldonado-Ocampo 2007; Mendoza-Cifuentes and Córdoba-Sánchez 2018).

Sampling. We established our samplings sites in five isolated patches of tropical lowland rain forest (locally known as "mata de monte") and gallery forests close to the Tomo and Orinoco Rivers (Fig. 1). Our sampling took place from August 23th to 29th, 2019, corresponding to the wet season. We captured the specimen reported during the sampling of small mammals. We used a total of 170 Sherman traps (8 × 9 × 23 cm, 10 × 12 × 38 cm and 8 × 9 × 30 cm; H.B. Sherman Traps Inc., Tallahassee,

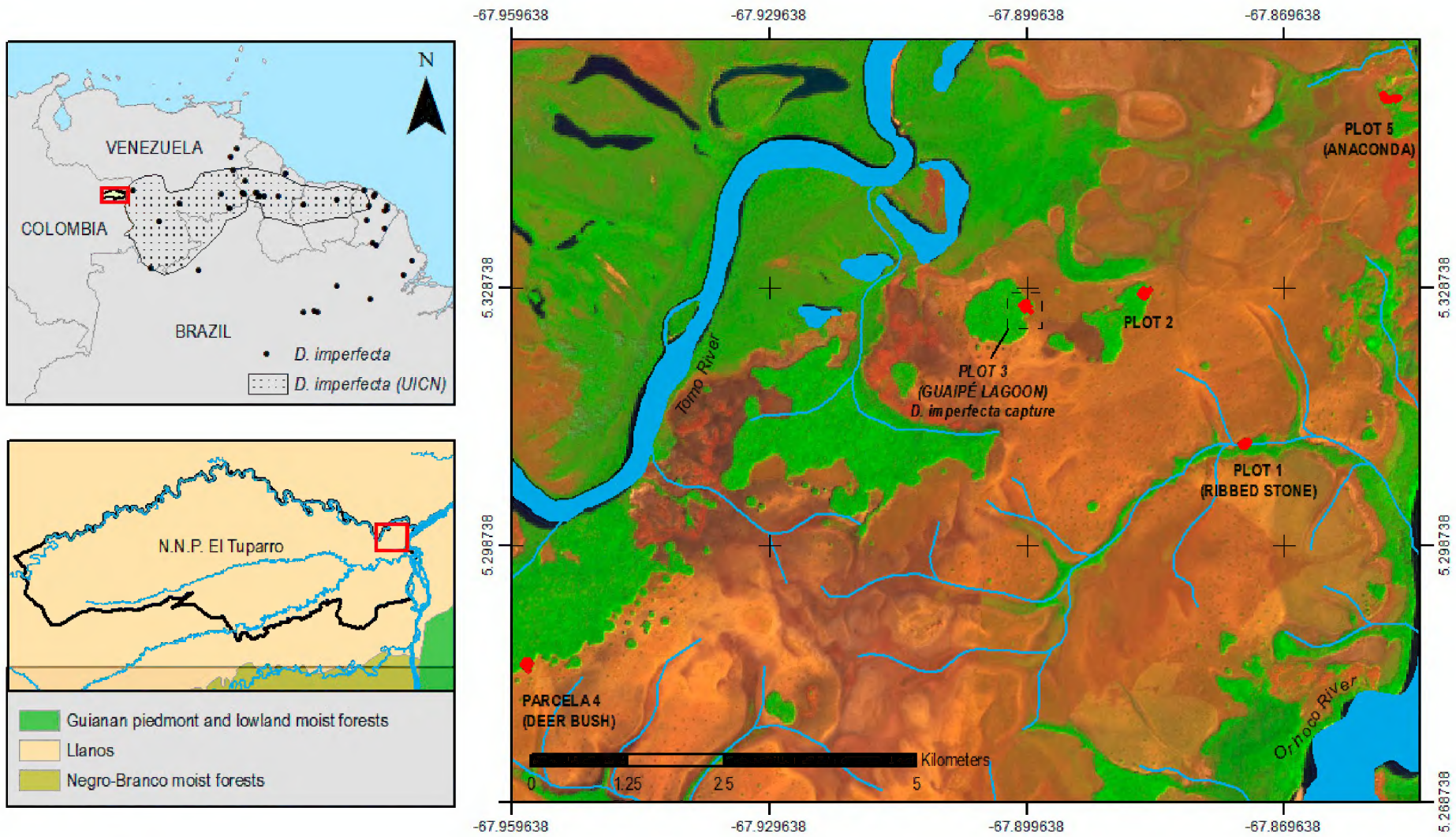

Figure 1. Geographical location of the study area and the sampling sites. Lower left: study area within the El Tuparro NNP. Upper left: *D. imperfecta* Mondolfi & Pérez-Hernández, 1984 reported geographical distribution according to the IUCN (polygon) (Pérez-Hernández et al. 2016); black dots correspond to species locations taken from The Global Biodiversity Information Facility (GBIF) and those reported by Ventura et al. (2002), Caramaschi et al. (2013), da Silva et al. (2013), Barros Faria and Melo (2017), and Rossi et al. (2017). Right: locations of plots within study area; *D. imperfecta* was captured in plot 3, the image corresponds to a true color combination of a Landsat image. Water components are represented by blue, savannas by brown, and forests by green.

Florida, USA). Traps were baited with a mix of peanut butter, oat, sardines, and banana essence, and activated at dusk. We left the traps for seven continuous days. Traps were monitored daily at dawn.

The individual was released at the same point where it was captured. We were unable to collect the *D. imperfecta* individual due to an administrative decision of the El Tuparro NNP. Fieldwork and captures were carried out under the research permit No. 20182000064181 of El Tuparro NNP.

Results

Didelphis imperfecta Mondolfi & Pérez-Hernández, 1984

Figures 1, 2

Material examined. COLOMBIA • 1 ♀; Colombia, Department of Vichada, Puerto Carreño Municipality, El Tuparro National Natural Park, Administrative Center El Tomo; 05°17.08′N, 067°57.4783′W; 98 m a.s.l.; 28 Aug. 2019; T.M. González captured; non-flooded tropical lowland rain forest fragment (mata de monte), small Sherman trap (8 × 9 × 23 cm).

Identification. We captured one adult female with two immature pups. The individual matched the external characteristics of *D. imperfecta*: ears black at the middle, with a white superior margin and base; and pronounced black facial marks over a whiter background that highlight the contrast between the two colors. The species can be distinguished of *D. albiventris* because this species has black spots at the base of the ear while the rest is white; and also of *D. pernigra*, that has completely white ears (Lemos and Cerqueira 2002; Ventura et al. 2002). Furthermore, both species, *D. albiventris* and *D. imperfecta*, have a whitish-gray facial background which results in less pronounced facial lines (Lemos and Cerqueira 2002) (Fig. 2).

Discussion

White-eared opossums have restricted distributions compared with those of black-eared opossums (Cerqueira 1985; Voss and Emmons 1996; Cerqueira and Tribe 2008; Tocchio et al. 2015). For example, *D. pernigra* populations are restricted in the Andean region and are reported to be found at elevations between 2,300 and 3,300 m a.s.l. (Ventura et al. 2002); and *D. imperfecta* is only found at lowland tropical forests and elevations ranging from 80 to 2,250 m a.s.l. within the countries of Brazil, Guyana, French Guiana, Suriname, and Venezuela (Fig. 1). On the other hand, *D. albiventris* has a wider distribution in South America, since is located in the Chaco biogeographic region, the Atlantic forests of Argentina, and open deciduous forests of Paraguay, Uruguay, Bolivia, and the center and south of Brazil (Cerqueira 1985; Voss and Emmons 1996; Ventura et al. 2002; Cerqueira and Tribe 2008; da Silva et al. 2013; Astúa 2015; Faria and Melo 2017; Rossi et al. 2017); Our results agree with those descriptions and distribution ranges; hence, it supports the identification of *D. imperfecta* and confirms its presence in the tropical lowland forests around of the Orinoco river in Colombia.

Previous to our record, the northern and eastern limits of the distribution of the species was the Orinoco River. This previous distribution could be explained by the non-random distribution patterns and the pronounced niche conservation trait of *D. imperfecta* (Tocchio et al. 2015).

Figure 2. Adult female of *Didelphis imperfecta* Mondolfi & Pérez-Hernández, 1984 captured at El Tuparro NNP.

These characteristics are affected by climatic conditions, geographical barriers and species-specific life traits such dispersion, movement capacity and body size (Nakazawa 2013; Kelt and Meserve 2014; Maximiano et al. 2020). Indeed, environmental conditions and geographical barriers, such as wildfires and the Orinoco River, can exert strong filters on the species spatial distribution patterns, but our results might indicate that *D. imperfecta* is able to overcome these potential constraints.

This is the first record of the species for Colombia. As such, this record increases the number of species of the family Didelphidae and genus *Didelphis* in Colombia to 39 and three, respectively. Our results can be used to update and enhance previous distribution models (see Tocchio et al. 2015; Pérez-Hernández et al. 2016). Currently, the Neotropical region is experiencing threats (i.e., loss and degradation of habitats, species illegal trafic and climate change) that jeopardize the biodiversity and the sustainability of the ecosystems (Dirzo et al. 2014; Kelt and Meserve 2014). The Guiana shield region of Colombia and Venezuela is inhabited by over 250 mammals species (Kelt and Meserve 2014), but lacks mammal sampling consistency and efforts, which can derive distributions maps with information gaps. Thus, is pivotal to understand the species ecology and biology, and to muster efforts to fill the gaps in mammals distribution patterns in order to establish and elaborate better management and conservation strategies.

Acknowledgements

This research was funded by Colciencias 757 National Doctorate Scholarship. We wish to thank to El Tuparro National Natural Park and its director Henry Pinzon for allowing us to carry out the study within the protected area. To Ivonne Rodriguez and our field crew. To Pedro Sanchez for lending us some Sherman traps. Fieldwork was funded by the project "Integración de la dinámica de la perturbación en la biodiversidad: el caso del fuego en ecosistemas de la Orinoquía" of the National grant for the support of research projects and artistic creation 2017-2018 of the Universidad Nacional de Colombia. The research was done with the permit of the El Tuparro NNP No. 20182000064181 of the November 2, 2018. This research was approved by the Ethical Committee of the Sciences Faculty of Universidad Nacional de Colombia, Bogotá, No 02-2018. Finally, we wish to thank to the reviewers for their comments and suggestion that greatly improved the manuscript.

Authors' Contributions

TMG and DA planned and designed the assessment. TMG, EM, NMN did the fieldwork and data entry, NMN identified the captured individual. TMG, NMN, EM and DA wrote the manuscript.

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